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Soil Moisture And The Citrus Tree Root System...

T. W. YOUNG
ASSOCIATE HORTICULTURIST
AT MEETING
FLORIDA STATE HORTICULTURAL SOCIETY

Of the environmental factors influencing the growth of citrus which may be controlled at least to some extent, first consideration should be given by the grower to the maintenance of favorable soil moisture throughout the root zone. The roots of bearing citrus trees usually extend laterally a few feet or more beyond the leaf drip. The depth of rooting is primarily dependent on soil texture and certain environmental factors more or less related to soil texture. An examination of the root systems of 17 bearing trees on sour orange and rough lemon stocks growing in heavy soils of low-lying East Coast groves revealed that the maximum depth of rooting here was about 2 feet. The ratio of roots to top was small. On the welldrained sandy soils it is not uncommon to find trees rooted 5 to 6 feet deep. Here the root to top ratio is large. Soil texture influences root growth both directly and indirectly. The lighter the soil texture the less the mechanical resistance to the growing root. Then there is a close relationship between soil texture and the ability of the soil to retain moisture in favorable amounts.

The importance of soil moisture is due not only to the need of a reserve supply in the soil to replace that lost by the plant through transpiration and the role water plays within the plant in all physiological processes, but also to the control exerted by soil moisture or other soil environmental factors essential to plant growth such as fertility and aeration. Soil moisture is necessary for the solution and movement of nutrients in the soil and their absorption by plant roots. Soil micro-organisms require favorable moisture condition for the breaking down of organic and mineral nutrient constituents into forms absorbed by roots. Even the soil temperature, which may vary within rather broad limits for roots and micro-organism functioning, is sometimes controlled more nearly the optimum by favorable soil moisture. Morever, the plant roots and most beneficial soil organisms cannot perform properly without sufficient soil aeration which is a function of soil moisture for any given set of soil textural and drainage conditions.

Soil aeration is very closely linked with the amount of moisture in the soil. The soil is a porous mass. Studies on Florida citrus soils have shown them to be from about 40 percent by volume pore space for the light sands to about 60 percent for some loams. These pore spaces are normally filled with air and water. Ideal conditions, on the average, would probably be when they were about half filled with air and half with water. Good plant growth is made, nevertheless, with rather wide variations from this air to water ratio. When healthy plants wilt and remain so through a night of high humidity, most of the pores in the soil in which these plants are rooted are filled with air. When the soil becomes waterlogged the converse is true. Roots cease to function in the absorption of nutrients or water if drought is severe or water-logging prolonged. In the latter case physiological drought results. Obviously it is the absence of air (oxygen) which really causes root damage under these circumstances. If water-logging is caused by frequent rains, which will carry fresh water containing some air into the soil, damage is likely to be less severe than when the same water remains without movement for days. Also damage is usually less severe in cool than warm weather because the absorption of air in water increases as the temperature decreases. Plants growing on heavy loams and muck soils usually withstand water-logged conditions longer than those on sands because of the considerably larger amount of very small pore spaces in the former from which air is expelled by water quite slowly.

The soil air near the surface generally contains slightly less oxygen than the atmosphere. The percentage of oxygen decreases with depth. The total volume of air in a given soil decreases with depth except where a false water table may be superimposed above the true water table by a hard-to-wet or impermeable soil layer. As far as the films of water on the soil particles are continuous and connect with the water table the forces tending to drain the soil decrease as the water table is approached. With depth the percentage of pore space filled with water increases. Immediately above the water-table there will be a layer of soil very near saturation.

It would be possible to have poor soil aeration even though a large portion of the pore spaces were filled with air with a high percentage of oxygen if the soil has been compressed by heavy equipment or otherwise so as to greatly reduce the pore space. This would not occur on sands but might occur in soils containing a high clay fraction. However, it probably is not a frequent source of trouble in the surface few feet of Florida citrus soils. Laboratory studies were made on the air holding capacity of a number of soils, representing eight series used for citrus. The soils were thoroughly wetted and drained to equilibrim with a force equal to that present in the soil over a water-table at 5 feet. While not absolute, data obtained in this manner do give a fairly close approximation of field conditions. It was found that the volume of air at a depth of 3 feet in a Manatee clay loam was about 13 percent of the soil volume. This value is the air capacity of this soil at 3 feet for these particular drainage conditions. The air capacity at this depth of the other soils examined ranged upward to about 34 percent for light sands. Of course the air capacity would increase as the soil surface was approached. An air capacity of about 10 percent is probably about the minimum for satisfactory root growth. In other words, with a water-table main-

(Continued on page 11)

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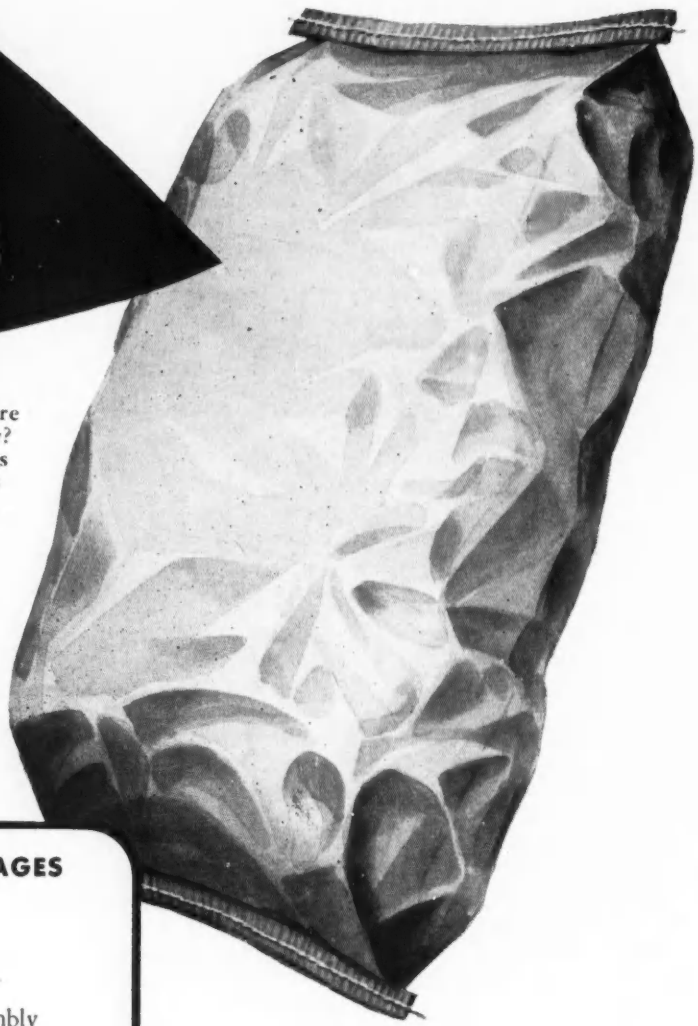

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Commercial Packinghouse Operations In Relation To Decay In Citrus Fruits(1) . . .

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That decay is an important economic factor in the marketing of Florida citrus fruits is recognized by most persons associated with the industry. Much work has been done on the causes of this trouble and it is well known that four species of fungi are responsible for practically all the decay which occurs during the marketing period. The fungi concerned are **Diplodia natalensis** and **Phomopsis citri,** causal agents of the stem-end rot and **Penicillium italicum** and **Penicillium digitatum** which brings about blue mold and green mold respectively.

While these fungi are the actual causes of decay, there are certain contributing factors such as the ethylene coloring room treatment and other conditions to which the fruits are subjected which may have a marked effect on the percentage of decay and the time of its appearance. One of these factors is wounding. By this we mean cuts, punctures or other breaks in the fruit peel which expose the albedo and allow for the entrance of certain decay fungi, especially the blue and green molds.

Since these wounds are due to mechanical injury there has been a widespread belief that rough handling in packinghouse machinery is responsible for a large fraction of decay in Florida citrus fruits. While it is important to know if this is true, no very extensive experimental investigation of what happens in commercial houses appears to have been made.

In 1907 Powell (3) from his observations concerning the effect of packinghouse processing on decay in California oranges concluded, "the brushing increases decay and washing increases it still more." He emphasized the need for careful handling to prevent rind punctures. In connection with experiments on various cleaners including soap Clark (1) in 1941 reported that washing Florida Valencia oranges with these detergents increased stem-end rot and that waxing the fruits caused a further increase in this type of decay.

Voorhees and Stearns (5) in a study of the effect of weather conditions on decay found that the difference in stem-end rot between processed and unprocessed Valencia oranges was inconsistent but there was a definite tendency for more rot to develop in the processed fruits. Stearns (4) reported a marked increase in the decay of tangerines due to complete processing when compared with fruits receiving only a wash. It is stated by Winston (6) that rough handling in packinghouses causes damaged fruit that is likely to develop green mold but no data is given in support of this contention.

On the other hand, Hopkins and Loucks (2) in a rather extensive study of fruit samples taken from commercial packinghouses reported that during the period from February to June 1943 they were unable to determine any effect of packinghouse operations on the amount of decay in citrus. This report was based on observation of 12,000 oranges taken from 6 packinghouses. No increase in stem-end rot or in mold decay was found to be caused by the processing.

Since in the latter work the samples collected were practically all Valencias oranges which were

1 Cooperative investigation by the Citrus Experiment Station, Lake Alfred and the Florida Citrus Commission, Lakeland, Florida.
2 Associate Plant Pathologist and Plant Physiologist respectively, Florida Citrus Commission.

not subjected to the ethylene coloring room treatment, it seemed desirable to set up a series of experiments including more commercial varieties and also to extend the investigation through the entire fruit season. In this way it was hoped to determine more exactly what effect, if any, packinghouse processes might have on fruit decay.

Inasmuch as fruit samples were taken from the packinghouse line only, at various points from the dump belt to the grading belt, the effect of the ethylene coloring room treatment and the effect of various packing and shipping methods were not included in this study.

Methods

Samples of fruits were taken from various commercial packinghouses throughout the 1947-48 season. There were 59 sets of such

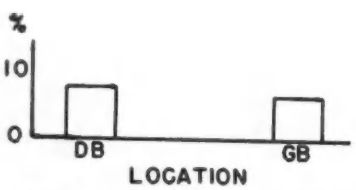

Figure 1. Average percentage of total loss in grapefruit taken from two locations in the packinghouse line.
DB—Dump belt
GB—Grading belt

samples collected from 23 houses throughout Central Florida; the total number of fruits amounted to 18,500. A varying number of samplings were made at each house. For each of the 59 sets of samples fruit was removed from the dump belt and from the grading belt and in 32 cases sampling was made at two additional points, just before and just after the color-add tank. Since 100 fruits were collected at each location in the packinghouse line the number of individual fruits in each sampling varied from 200 to 400.

By removing samples of fruit from the various points in the same order in which the fruit passed through the machinery it was possible to obtain fruits from practically the same lot in each case. In this way the samples collected were as near alike as possible except for differences the packinghouse machinery might have caused.

The samples were taken at once to the storage rooms of the Citrus Experiment Station at Lake Alfred where each lot was randomized one fruit at a time into four sublots of 25 each. Decay records of stem-end rot and mold were made at one, two and three weeks from the picking date for each of the sub-

Table 1.
The Mean Temperature and Relative Humidity Maintained in the Storage Rooms.

Period	Mean Temp. °F.	Mean Relative Humidity %
Oct. 13, 1947 to Nov. 17, 1947	82.5	80
Nov. 17, 1947 to Feb. 1, 1948	77.8	90
Feb. 18, 1948 to April 5, 1948	82.2	90
April 5, 1948 to June 7, 1948	71	85

lots. Statistical analyses were made to determine the significance of results obtained.

The storage rooms were held at a fairly regular temperature that varied somewhat during a portion of the season with outside temperatures. The seasonal temperature variation as shown in Table 1 was from 71° to 82.5°F. while the relative humidity ranged from 80 to 90 percent. Temperature control equipment was installed on April 5, 1948 and thereafter the temperature was held at 71°F.

The fruits taken for this study represented nearly all types of

Table 2.
Average Decay in Grapefruit Taken from 9 Houses, 2,200 Fruits.

Location	S.E.R. %	Mold %	T.L. %
Dump belt	7	0.5	7.5
Grading belt	5	1	6

S.E.R.—Stem-end rot
T.L.—Total loss

packinghouse procedures. Some were degreened by gassing in coloring rooms either with ethylene or with fumes from kerosene burners while others were not gassed. The majority of the oranges were given the color-add treatment. Some fruits received a borax or other decay control treatment. All samples from the grading belt were dried, polished and waxed. The waxes applied were those being used commercially at the present time. None of the tangerines received a color-add treatment.

Where the color-add process was not used, as in the case of tangerines, samples were taken before and after the color-add unit to check on effects of possible mechanical injury in this part of the packinghouse line.

Results

The average amounts of decay from all locations in all the packinghouses were 7, 54 and 62 percent for grapefruit, oranges and tangerines respectively. This agrees in a general way with the decay reports from northern markets where not much loss was encountered with grapefruit, but many tangerine shipments were excessively bad.

Grapefruit.—Among the grapefruit samples collected were the varieties Marsh, Duncan, Excelsior and Silver Cluster. Practially all samples were removed from the

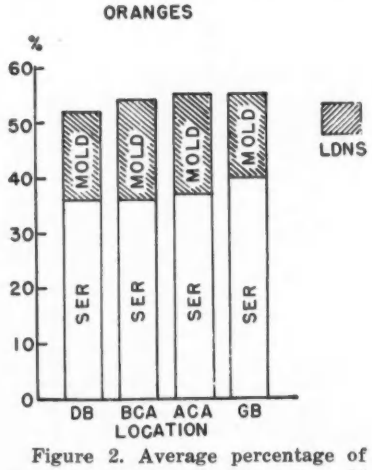

Figure 2. Average percentage of total loss, stem-end rot, and mold in oranges taken from four locations in the packinghouse line.
DB—Dump belt
BCA—Before color-add tank
ACA—After color-add tank
GB—Grading belt
LDNS—Least difference necessary for significance at the 5% level

dump belt and the grading belt only. The results obtained from nine houses from which 2,200 fruits were taken are given in Table 2, and shown graphically in Figure 1. The total loss from the dump belt fruit was 7.5 percent and from the grading belt 6 percent; practically all decay was from stem-end rot, that from mold being negligible. Obviously the packinghouse did no damage to these fruits.

Oranges.—The orange samples consisted of the varieties Hamlin, Parson Brown, Pineapple, Jaffa,

Homosassa, Valencia and a few Temples. They were taken from 17 houses and amounted to 10,000 individual fruits. Samples were taken from four locations in the packinghouse line as before mentioned. The average percentage of stem-end rot and of mold recorded for oranges obtained from each of the indicated points is shown in Table 3 and Figure 2.

The total loss from decay from the dump belt fruits was 53 percent and from grading belt fruits 55 percent. Intermediate locations showed values equal to or between these. Since the least difference necessary for significance, at the

Table 3.

Average Decay in Oranges Taken from 17 Houses, 10,000 Fruits

Location	S.E.R.	Mold	T.L.
	%	%	%
Dump belt	37	16	53
Before color-add tank	36	18	54
After color-add tank	37	18	55
Grading belt	40	15	55
LDNS	5.3	4.1	

S.E.R.—Stem-end rot
T.L.—Total loss
LDNS—Least difference necessary for significance.

5 percent level, between these averages is 5.3 percent, the difference between 53 and 55 percent has no meaning. It is equally evident then that here the processing had no effect on either of the two types of decay.

Tangerines—In all 14 samplings were made of tangerines from commercial houses. The average total decay of fruits from the dump belt was 56 percent and from the grading belt 81 percent or an increase of about 45 percent due to processing. In eight of these samplings the tangerines were taken from 4 locations, the results of which are shown in Table 4 and Figure 3. Here the losses from total decay were 58, 62, 65 and 82 percent for the 4 respective positions. Since the least difference necessary for significance was found to be 8.4 percent, no significant difference exists between the first 3 locations but does exist between these and the grading belt samples. A breakdown of the data shows that this increase caused by the waxing and polishing operation is due to a significantly greater amount of stem-end rot and not an effect on mold.

Discussion

It is evident from the results presented in this paper that the packinghouse machinery proper is not responsible for the large amount of decay which occurs in Florida citrus fruits during the marketing period. In the case of grapefruit which showed a relatively small percentage of decay the total loss at the grading belt was slightly less than at the dump belt. The difference is, of course, not significant but certainly shows there was no effect of processing in increasing decay.

Oranges which developed much higher amounts of decay likewise showed no such effect. There is no significant difference in stem-end rot or in mold from one end of the packinghouse line to the other and the total decay is practically the same throughout.

As previously mentioned tangerines were the only citrus fruits included in this study which showed

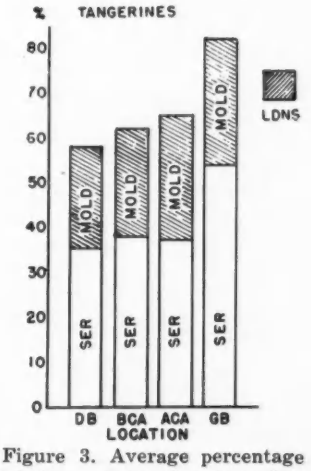

Figure 3. Average percentage of total loss, stem-end rot, and mold in tangerines taken from four locations in the packinghouse line.
DB—Dump belt
BCA—Before color-add tank
ACA—After color-add tank
GB—Grading belt
LDNS—Least difference necessary for significance at the 5% level

increased decay due to packinghouse processing and this increase was apparently caused by the final drying, waxing and polishing operation. It should be pointed out that even in this case the processing was not responsible for the bulk of the decay since the total loss in the dump belt samples was 58 percent.

The results obtained in this study which covered the entire 1947-48 fruit season and included many varieties of citrus fruits agree very well with our data (2) on Valencia oranges collected in 1943 and give a more complete picture of the relationship of packing house processing to decay. It should not be concluded from these data that reasonable care in the handling of citrus should not be observed. In fact there were certain cases where it appeared that damage was being done to oranges by the processing. However, time did not permit the taking of a sufficient number of samples from a given house to establish this with any degree of

Table 4.

Average Decay in Tangerines Taken from 5 Houses, 3,200 Fruits.

Location	S.E.R.	Mold	T.L.
	%	%	%
Dump belt	35	23	58
Before color-add tank*	38	24	62
After color-add tank*	37	28	65
Grading belt	55	28	82
LDNS	8.4	8.3	

* No color-add treatment used
S.E.R.—Stem-end rot
T.L.—Total loss
LDNS—Least difference for significance.

certainty. Since the drying, waxing and polishing operation increases the amount of decay in tangerines, they appear to present a unique problem which needs further investigation. However, the overall picture for other citrus fruits indicates that there was no decay increase caused by processing.

In respect to other factors which influence decay in citrus fruits and not considered in these experiments it is well known that careless picking with resulting clipper cuts, stem-punctures and plugged fruits, as well as other injuries caused while packing and shipping, tends to increase the amount of decay from Penicillium molds. While care in these matters should be practiced it will not prevent the large loss caused by stem-end rot. It is also known that the ethylene coloring room treatment is responsible for increases in stem-end rot, but so long as this degreening process is considered essential and no permissable effective fungicidal treatment is available there seems to be no means of avoiding this increase.

(Continued on page 9)

Standardization Of Canned Citrus Juice By The Use Of Partial Concentration . . .

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The object of the work to be reported on this afternoon was to find out if a low-solids and low-acid orange juice could be improved in quality by concentration. The term "standardization" as used here will refer to the partial concentration of orange juice to raise the Brix and acid to minimums of 10.5 degrees and 0.75 per cent respectively. It is possible that if internal grades for fresh fruit are raised, standardization of canned citrus juices by partial concentration may offer a possible use for some fruit with solids content under that required for fresh fruit.

Three experimental packs, consisting of a control and two partially concentrated juices, were put up in plain tin cans and stored at 40° and 80°F., and examined initially, and at the end of three and six months. After storage for three months at 80°F., samples of the three juices were sent to all Florida citrus processors for taste comparisons. The results of these taste tests indicated that the quality of the orange juice had been improved by partial concentration.

EXPERIMENTAL

Procedure:

The oranges used in this work were Hamlins obtained from certain experimental plots at the Citrus Experiment Station, Lake Alfred, Florida. These grove-run oranges were specially chosen for their low-solids content in an effort to show what could be done to standardize as poor a sample as is likely to be encountered in a canning operation. The fruit was washed at the Citrus Experiment Station and then trucked in field boxes to the U. S. Citrus Products Station, Winter Haven, Florida, where it was held at about 40°F. for four days before processing on December 31, 1946.

The juice was extracted using a Rotary Juice Press, passed through a 0.030 inch screen, and held in a stainless steel holding tank until the quantity of juice needed for the packs had been collected. The juice was then processed further as follows:

Control pack: — A quantity of deaerated juice was used for the control pack.

Concentrate-added: — A quantity of the juice was concentrated under vacuum to 55 degrees Brix at a temperature of 90°F. This 55 degrees Brix concentrate was then added to a quantity of deaerated juice to adjust the Brix to at least 10.5 degrees. Table 1. calculated from sucrose values (1), gives the gallons of 55 degrees Brix solution to add to 100 gallons of a given low-Brix solution to obtain a 10.5 degrees Brix solution, and may be used as an approximation for citrus juices.

Concentrated pack:—The remainder of the juice was concentrated under vacuum to at least 10.5 degrees Brix at a temperature of 90°F. Table 2, calculated from sucrose values (1), gives the gallons of water to evaporate from 100 gallons of a given low-Brix solution to obtain 10.5 degrees and 55 degrees Brix solutions.

The "Control", "Concentrate-added", and "Concentrated" juices were pastuerized at 200°-205°F., filled at 190°-195° F. into 9½ fluid ounce cans (1.25 hot dip tin plate), sealed, and cooled. In general, the canned juices showed a 9 and 10 inch vacuum and a gross headspace of 3-16 to 4-16 inch.

Each of the three packs consisted of approximately 10 cases of 24 cans each, and a part of each pack was placed in storage at 40° and 80°F.

Results:

The initial analysis of the juice packs for Brix, total acid, and ascorbic acid, is given in Table 3. It will be noted that the "Control" juice is low in Brix (7.43 degrees) and acid (0.55 per cent), and that the "Concentrate-added"

TABLE I.

Gallons of 55° Brix Solution to add to 100 Gallons of a given Low-Brix Solution to obtain a 10.5° Brix Solution (Based on Sucrose Values)

Given Brix		7.0	7.5	8.0	8.5	9.0	9.5	10.0
Desired Brix	10.5	6.4	5.5	4.6	3.7	2.8	1.9	0.9

TABLE II.

Gallons of water to evaporate from 100 gallons of a given Low-Brix Solution to obtain 10.5° and 55° Brix Solutions (Based on Sucrose Values)

Given Brix		7.0	7.5	8.0	8.5	9.0	9.5	10.0
Desired Brix	10.5	34.3	29.4	24.6	19.7	14.8	9.9	4.9
	55	89.6	88.9	88.1	87.3	86.5	85.8	85.0

TABLE III.

Initial Analysis of the Canned Orange Juices

	Control	Concentrate-Added	Concentrated
°Brix	7.43	10.65	10.70
Total Acid, %	0.55	0.79	0.78
Ascorbic Acid, MG./100 ML.	39.8	58.4	59.3

*Paper prepared by Edwin L. Moore and delivered by C. D. Atkins at the 61st Annual Meeting of the Florida State Horticultural Society, West Palm Beach, Florida, October 28, 1948. This paper is condensed from a previously published article titled, "An Experiment on Partial Concentration As a Means of Standardizing Low-Solids Orange Juice", by Edwin L. Moore, L. G. MacDowell, C. D. Atkins, and Richard L. Huggart, that appeared in Fruit Products Journal, Vol. 27, pp. 72-74 (November, 1947), and is reprinted with the permission of Fruit Products Journal.

and "Concentrated" juices have been standardized to at least 10.5 degrees Brix and 0.75 per cent acid. Also, the high ascorbic acid content of the "Concentrate-added" and "Concentrated" juices will be noted.

All three juices stored at 40°F. for six months retained about 97 per cent of their initial ascorbic acid content. During storage at 80°F. for the same period of time, all juices retained about 88 per cent of their initial ascorbic acid content with no significant differences between the packs.

After storage for three months at 80°F., coded samples of the three juices, with some descriptive information, were sent to all Florida citrus processors with the request that the juices be tasted by the members of each organization. A questionnaire was enclosed to be filled out and returned to the Research Department of the Florida Citrus Commission.

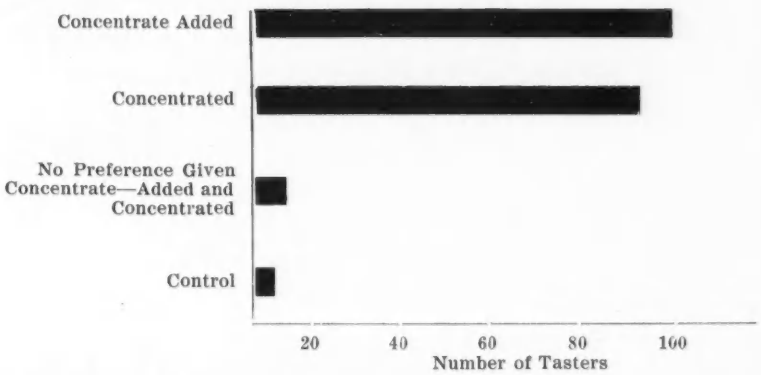

FIGURE I — Preferences of Tasters for the Canned Orange Juices after storage of Juices for 3 Months at 80°F.

Thirty-nine canners, represented by 210 tasters, generously cooperated in tasting these samples of orange juices and returning the questionnaires. These results are presented graphically in Figure I.

Of these 210 tasters, 103 preferred the "Concentrate-added" juice, 94 preferred the "Concentrated" juice, 8 had no preference between the "Concentrate added" and "Concentrated" as the best juice, and 5 preferred the "Control" juice. From these results on taste tests, it would appear that the quality of the orange juice had been improved by either method of concentration used.

SUMMARY

Three experimental packs, consisting of a control and two partially concentrated juices, were put up in plain tin cans and stored at 40° and 80°F. The packs were analyzed initially and at the end of three and six months to study partial concentration as a means of standardizing low-solids and low-acid orange juice to improve its quality.

No significant differences in retention of ascorbic acid were found between the packs at the end of the storage periods.

Thirty-nine canners, represented by 210 tasters, cooperated in tasting the packs of juices after the juices had been stored at 80°F. for three months. The results of these taste tests indicated that the quality of the orange juice had been improved by partial concentration.

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(1) Handbook of Chemistry and Physics. 26th Edition., pp. 1548-1549, (1942) Chemical Rubber Publishing Co., Cleveland, Ohio.

COMMERCIAL PACKINGHOUSE OPERATIONS IN RELATION TO DECAY IN CITRUS FRUITS.(1)

(Continued from page 7)

Summary and Conclusions

Practically all of the commercial varieties of citrus are represented in this report by samples taken during the 1947-48 fruit season. A total of 18,500 fruits were obtained from 23 different packinghouses, representing various types of machinery and processing methods. Sets of samples were so obtained and handled that the data concerning development of stem-end rot and mold in fruit taken from various locations in the packinghouse line could be analyzed statistically. The comparative results after 3 weeks storage showed that the packinghouse machinery caused no increase in loss from decay in either grapefruit or oranges. The average total loss from decay in grapefruit that did not pass through the packinghouse line was 7.5 percent with 6 percent for those that did. The corresponding results from oranges were 53 and 55 percent, and from tangerines 58 and 82 percent. Increased decay in tangerines was due to an increase in the amount of stem-end rot among those fruits which were dried, waxed and polished in the packinghouse as compared to those that were not so treated.

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HAVE WE TOO MANY COOKS?

That the Florida citrus industry is in a bad way, everyone conversant with the situation agrees. It is also agreed that the industry needs some Moses to lead it out of the wilderness.

Some months ago leaders in the industry conceived the idea of a super-cooperative, owned, managed and controlled by growers, with a view to exerting control over shipments, quality and avenues of distribution. This idea grew and out of it came the temporary organization of Florida Citrus Mutual.

The purpose was to sign up at least 75 percent of the total citrus tonnage of the state and a membership campaign was put underway. Up to this time the required tonnage is still lacking, but the drive goes on.

Now, instead of one great statewide organization, we have two, Mutual and Florida State Citrus Growers' Association. Then there is Governor Warren's proposed plan for legislative aid to the industry, Senator Pepper's plan for federal aid, and the new proposal put forward by a group of processors, all with the same end in view — better prices to the growers — but traveling over different routes. Just as in times past we have had wide differences among growers themselves, now we have the added differences between the growers and the processors.

Instead of one great organization we have two and still others in the making. What the industry needs and must have if it is to survive, is one overall organization taking in growers, shippers and processors. This is recognized by citrus leaders and affiliated interests as evidenced by the fact that many fertilizer concerns are advising their salesmen to solicit memberships for such an organization — Florida Citrus Mutual. If the tonnage now signed up by Mutual and that pledged to Florida State Citrus Growers' Association could be combined, the Florida citrus industry would have just such an organization, with the authority and the power to act for the welfare of every element of the industry through the unified efforts of growers in a centralized and effective body.

Citrus growers have been at cross purposes since the industry was first established in the state—with resultant loss to the growers. With the memory of recent and present losses in mind, it would seem to be the part of wisdom to stop fighting among themselves and get together in unity of purpose and unity of action.

FLORIDA CITRUS MUTUAL WILL CONTINUE DRIVE

At a meeting in Lakeland on December 23, the temporary directors of Florida Citrus Mutual decided to continue the membership drive in the hope of securing the necessary signatures to assure control of seventy-five percent of the citrus tonnage of the state, the minimum considered essential to the successful operation of the super-cooperative.

Encouraged by recent additions to the membership role as the result of campaigns being carried on by business and professional men in citrus territory, the directors believed that it was possible to secure the requisite tonnage in time to complete organization and begin to function during the present shipping season.

It was stated that during the ten days prior to the meeting some 1,500,000 boxes of fruit had been signed up and that another 1,000,000 were in sight. With the various committees diligently working in numerous communities, it was decided to push the drive to the limit during the next two weeks. Many growers, shippers and civic bodies exerted pressure to continue the campaign in the hope that the requisite tonnage may be secured without further delay. It was this evidence of confidence in the plan proposed by Mutual that had much to do with the decision of the directors to go ahead with renewed vigor.

It was pointed out that in order to become effective during the present season final organization must be made within the next two weeks, otherwise putting the plans of the organization into operation would be delayed until next shipping season.

With this fact in mind, it would seem that there should be no further delay on the part of the growers to sign contracts at once and get Mutual into active operation.

FLORIDA STATE CITRUS GROWERS' ASSOCIATION

Meeting in Orlando recently members of local organizations of citrus growers in several Florida counties organized a state association to be known as Florida State Citrus Growers' Association with which the county units are affiliated.

The object of this association is to control the on-tree price of fruit to the grower through an agreement by each member to sell his fruit at a price no less than that established by the Association.

Some seven county units were represented at the meeting and it was stated at the time of the organization of the state association that some 11,000,000 boxes of fruit were pledged.

Officials of the new Association declared that they were not opposing Florida Citrus Mutual, but felt that their own organization afforded the better plan and offered greater benefits to the growers. Only actual growers are eligible to membership in the Association which takes no account of shippers and processors, save as they may be influenced by numbers to protect their own interests by going along with the new organization.

It is stated that new county units are being formed and that the tonnage pledged is steadily growing. The organization has the backing of some prominent men in the industry.

SOIL MOISTURES AND THE CITRUS TREE ROOT SYSTEM

(Continued from page 3)

tained at about 5 feet all these soils could support root growth to a depth of at least 3 feet so far as aeration was concerned. With the water-table controlled at a greater depth trees could root deeper than this so long as the soil texture was favorable. Impervious soil layers near the surface sometimes preclude deep rooting regardless of other factors.

It is conservative to say that water has killed and damaged more trees in Florida during the past year or so than any other one cause. The high incidence of water damaged roots, particularly in coastal areas, is evidence that this trouble is more widespread than generally supposed. Damage has occurred where water did not stand in the middles for prolonged periods. There is sometimes a question in the mind of the grower how water can damage roots when it does not stand in the grove. The installation of a few shallow water-table wells might sometimes be enlightening—and perhaps profitable. Sub-drainage is frequently inadequate. We have a number of water-table wells in three groves on different soil types in the Vero area. From these we have found that water often stands near the soil surface in the beds when there is none in the middles. Occasionally it was found to stand sufficiently high in the soil for a couple of weeks to cause root damage below about the 18 inch level. Lateral movement of water through most of the loamy soils is slow. Percolation downward is considerably more rapid. To remedy a situation where periodic water damage occurs may call for more and deeper ditches. In some cases pumps and/or dykes must be installed. The necessary water control set-up will vary from grove to grove. There is no rule-of-thumb for an adequate drainage installation. In the Indian River section a layer of sand and shell is frequently encountered at a depth of about 4 feet or more. Water percolating downward to this will move out rapidly to ditches cut into it if the ditches are kept at a sufficiently low level. The sand hill areas usually present no drainage problem except where water from higher areas seeps to slopes and must be controlled by diversion ditches. Some of the lower lying sands are underlain with hard-pan or clay-pan. Lateral movement of water over the surface of these impervious layers may be relatively rapid but movement downward through them is greatly retarded. Judiciously placed ditches at least to the pan depth and sometimes pumps are necessary to permit rooting to as great a depth as the impermeable layer will permit on these soils.

The other side of this soil moisture picture is the maintenance of

(Continued on page 14)

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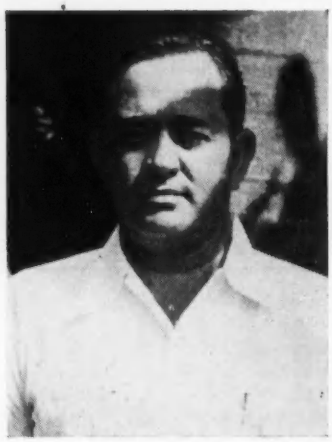

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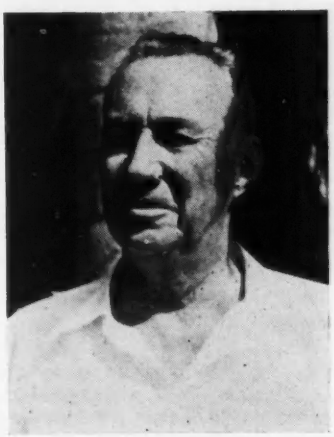

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SOIL MOISTURES AND THE CITRUS TREE ROOT SYSTEM

(Continued from page 11)

adequate soil moisture during periods of drought. On the light, sandy, well-drained soils sprinkler pipe irrigation has been fairly satisfactory. In the artesian areas of the coastal regions flooding between the middles of bedded groves is the method most extensively used. This often is not satisfactory. It is not uncommon to find trees wilted during and immediately after irrigation. Studies conducted a few years ago on several representative coastal soils showed that frequently little water percolated to the principal root zone even after prolonged flooding of middles except on light sands. Sometimes in an effort to get water into the upper portion of the root zone the period of flooding is of such duration that roots will be killed in the lower portions. Morever, flooding consumes immense quantities of artesian water. With increased acreage the number of wells have increased. During periods of drought the demand is so great that the flow of individual wells is decreased. Thus it takes longer to get over a given acreage. Drought damage may occur before irrigation is completed. Additional wells are required for a given acreage. The flow is further reduced as the number of wells increase. With this ever increasing use of artesian waters there is likely to be an increase in saltiness of the water. This has occurred in the Indian River section. The salt content of a number of index wells has been determined annually for the past seven years. This annual survey now includes about 160 wells scattered from Stuart to near Oak Hill. The trend in this area has been a gradual but general increase in salt. During the past year or so rainfall has been excessive throughout the state. The aquifers probably have freshened somewhat. Nevertheless, in Brevard County there was an average net increase this year in salt even though the wells were little used. The wells in the area farther south showed a slight average decrease, but are still more salty than they were a few years ago.

A few growers in the coastal areas are now using sprinkler irrigation. A satisfactory response is obtained but there is some question as to whether irrigation is required often enough over a period of years to make it economically feasible. The Citrus Station, in cooperation with T. A. Peebles of Vero Beach, has set up a field plot experiment to gather information on this matter. The experiment is designed to get a comparison of costs and returns from sprinkler irrigated, flood irrigated and non-irrigated plots. Irrigation has been necessary in order to maintain satisfactory moisture in the root zone only on four occasions in the two years since the experiment was established. Sufficient rain fell within at least several days after each irrigation to provide good moisture in all plots and eliminate any significant difference between plots with respect to moisture. Yield records for the two years show no statistical difference between treatments. In all probability eight or ten years will be necessary to collect reliable data of this sort. Recently we have been able to establish a somewhat similar, although more elaborate, set of irrigation plots on the St. Lucie County grove made available for Station use last year by the County Commission through the efforts of the Indian River Citrus League. The plots include oranges and grapefruit on both Parkwood and Sunniland soils.

The length of time a grove will hold up during drought without irrigation is dependent to a great extent upon the spread and depth of the root system. The influence of evaporation extends to a depth of about 6 to 12 inches depending upon soil texture. The loss of water below this from a soil, once moisture is in equilibrium with the forces tending to drain it rapidly is primarily through plants growing in the soil. Because of evaporation from the soil surface the depth of rooting may be more important than the spread in maintaining plant growth during prolonged drought. However, in general, trees set at wide intervals will endure more drought than narrow spaced trees. This is because the wider spacing provides a larger reservoir of water on which the tree may draw. The depth of rooting is equally as important as the soil texture to which it is related. The importance of the depth of rooting and the soil texture can both be illustrated by a joint consideration of the moisture characterictics of two soils of rather wide differences in texture and drainage. For example, assume two trees of equal age and top size and both spaced 25 by 25 feet in the grove. One is on a well-drained Norfolk sand and is rooted 4 feet deep. The other is on an imperfectly-drained Felda fine sandy loam (tomato land). It is rooted to a depth of 2 feet. Allowing for a slight difference in the volume weight of the two soils, the volume of soil occupied by the tree roots in Norfolk will weight about 230,000 pounds. The tree on Felda is rooted only half as deep and occupies a volume of soil weighing 112,500 pounds. After being thoroughly wetted and drained to equilibrium with a water-table at 6 feet, the surface 4 feet of Norfolk soil will average about 4 percent moisture by weight. This is the field capacity of this soil layer for these particular drainage conditions. Under the same conditions the surface 2 feet of Felda soil will average about 10 percent moisture (field capacity). Plants (any) will remain permanently wilted, even overnight with dew on, when the moisture in the soil in which they are growing is reduced to the wilting point for that particular soil. For Norfolk sand this is about 1.5 percent moisture by weight and for Felda loams the average is about 5 percent. The moisture available to the plant is that present in the soil between the field capacity and the wilting point of that particular soil. The available moisture to the tree in Norfolk is 2.5 percent of the 230,000 pounds of soil in which it is rooted, or 5,750 pounds of water. The available moisture for the tree in Felda is 5 percent of 112,500 pounds, or 5,625 pounds of water. Thus, while the fine textured Felda soil has a higher moisture holding capacity there is slightly less moisture available to the tree in it because of the relatively high wilting point and the shallowness of rooting.

The values used for field capacity and wilting point in this example were obtained by laboratory determinations. They are subject to some error and at best there is always some range. They are to be considered only as approximations.

COONEY JOINS SULPHUR CO.

Flag Sulphur and Chemical Company, Tampa, Florida, has announced the appointment of Ray H. Cooney as Field Representative in Florida. Mr. Cooney joined the Flag organization on January 1, 1949, having spent several years with the Sales Department of the Adams Packing Company, Auburndale. Mr. Cooney will make his home in Winter Haven.

However, they are in fair agreement, on the average, with the moisture content of these soils as determined direct on soil samples from the field taken under varied conditions. This hypothetical case demonstrates how a tree on a fine textured soil like Felda, with a relatively high water holding capacity, may wilt during drought as soon as one on sand with a low water holding capacity.

The implications of the foregoing discussion are obvious. The larger the volume of well-drained yet moist soil available to the tree for rooting, the more successful will be its culture. The larger soil volume not only provides more moisture but it is also a larger storehouse for inherent nutrients and those applied in the fertilizer.

On the light well-drained sands, where surface evaporation is severe, irrigation to a considerable depth should be profitable. On the imperfectly-drained soils improving drainage so as to have good aeration to a depth of several feet is indicated. In some cases the friable soil is only a couple of feet deep. There it little or nothing to be gained in draining more than a few feet below the friable soil layers. Neither is there any advantage to draining much below the level at which the ground water can be maintained relatively stable during the wet season. The height to which water rises is not so important in this connection, however, as how long it stays there. There is no ultimate benefit in growing roots to a depth where a short time later they will be killed by water. If the drainage or subsoil texture is such that the trees necessarily are rooted shallow, then citrus, like herbacious plants, shows the most vigorous growth with moisture near field capacity. Under such conditions on heavy soils where the nitrogen supply is high the carbohydrates are likely to be utilized for top growth at the expense of the roots. The top to root ratio becomes unbalanced. If flooding occurs the roots may be reduced even further. When flooding occurs, particularly in the summer, it is likely to be followed immediately by high transpiration. The supply of moisture to the fruits is reduced and small fruits result that season. With the long growing season normal for Florida and sufficient nitrogen, vegetative top growth is always inclined to develop at the expense of the roots when moisture is ample. Without irrigation through the occasional droughts shallow rooted trees may loose sufficient wood from time to time to actually be reduced in size eventually. On the other hand, these same trees if rooted deeply by proper drainage and water control would continue to make good growth year after year—perhaps without any irrigation. There is no question that irrigation is beneficial at times on the heavier soils in the low-lying areas. Nevertheless it is problematical whether it would pay for a very great investment under average weather conditions on the majority of these soils if proper control of the ground water could be secured.

4-H CLUB GIRLS HELP

St. Lucie County 4-H club girls recently folded 3,500 letters, placed them in envelopes, and helped to address them in the Christmas Seal Campaign. The girls did the work as a community project, according to Miss Irene Roberts, home demonstration agent.

A farm inventory furnishes the basis for any other accounting desired.

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The Canners And The Federal Wage And Hour Law

FROM AN ADDRESS BY
JOSEPH C. NOAH
REGIONAL DIRECTOR,
BIRMINGHAM

Of The Wage and Hour and Public Contracts Divisions, U. S. Department of Labor, Before the Florida Canners Association, St. Petersburg, Florida, October 15, 1948

During the 10 years the Divisions have administered the Fair Labor Standards Act (the Federal Wage and Hour Law) we have found that the vast majority of employers make a conscientious effort to comply with it. In particular, I am able to say—with pleasure—that the canning industry has made special efforts to come into compliance. It is my sincere hope that what I say today will help solve any remaining problems that might result in inadvertent violations.

Although most of you are doubtlessly familiar with the basic provisions of the Wage and Hour Law, a brief reminder of them may be in order, as a foundation for the details on how specific provisions apply to the canning industry.

Thus, the law requires payment of a minimum wage of not less than 40 cents an hour, and overtime pay of not less than one and one-half times the employee's regular rate for all hours over 40 in a workweek. As you may recall, these minimum wage and overtime provisions apply to employees engaged in interstate commerce, or in the production of goods for interstate commerce, including employees whose occupations are necessary to the production of goods for interstate commerce. However, it is not necessary to pay all such workers according to these minimum wage and overtime provisions because under the law certain employees are specifically exempt.

As canners, you of course will be interested in those exemptions which have particular bearing on your industry. Generally speaking, fresh fruit and vegetable canners are able to claim exemptions from the overtime provisions during a total of 28 weeks in the year. Moreover, those canners who are within the "area of production" may be able to take an exemption from both the minimum wage and overtime provisions on a year-round basis.

"CANNING" DEFINED

But before I go any farther, I should first make it clear what the Divisions mean by the term "canning" so that there will be no confusion about activities for which you may claim exemption.

Included within the scope of canning operations and the sterilizing or pasteurizing which is an integral part of the canning process, together with the necessary preparatory operations which are performed on these commodities before they are placed in bottles, cans or other hermetically-sealed containers. In addition, sealing and labeling the containers, as well as placing them in cases or boxes, are considered to be canning operations when performed as a part of the uninterrupted canning process.

On the other hand, some operations which are not within the exemptions I shall discuss are the manufacture of cartons, cans, boxes and other containers, the manufacture of labels and the activities of canning workers.

And next, I'd like to insert just a word of caution—when the overtime exemptions apply, don't forget that employees must still be paid at least 40 cents an hour, whether during overtime or non-overtime hours.

EXEMPTIONS DISCUSSED

The first of the two overtime exemptions I'll discuss permits certain employees whose employers are engaged in canning perishable or seasonal fresh fruits or vegetables to work an unlimited number of hours at straight-time pay during a total of 14 weeks in the calendar year. Some of you may be interested in hearing that this exemption also includes the first processing and packing of these commodities.

It is important to remember that the application of this exemption is restricted to establishments where these operations are carried on. Furthermore, the exemption applies **only** to those employees who are actually engaged in the canning, or in first processing or packing, of fresh fruits and vegetables and to those workers whose occupations

LYCHEE NEWS

Fortunes have been made in other states with the growing of new fruits, of which dates, figs and nectarines are examples.

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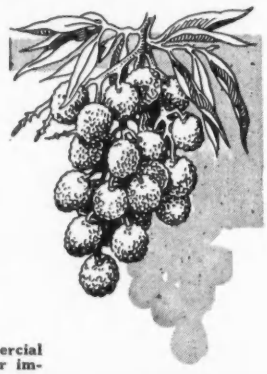

For information about the delicious Lychee and its commercial possibilities; for prices on trees in containers ready for immediate planting, write

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are a necessary incident to these activities and who work solely in those portions of the premises devoted by their employer to these activities. Among employees who are considered to be engaged in occupations which are incident to canning are those office employees, watchmen, maintenance workers and warehousemen whose work relates exclusively to canning fresh fruits and vegetables.

You may also find it helpful to remember that during those weeks when a plant is **exclusively** engaged in canning perishable or seasonal fresh fruits or vegetables, all employees working in the plant are considered to be within this exemption.

"SEASONAL" EXEMPTION IS LIMITED

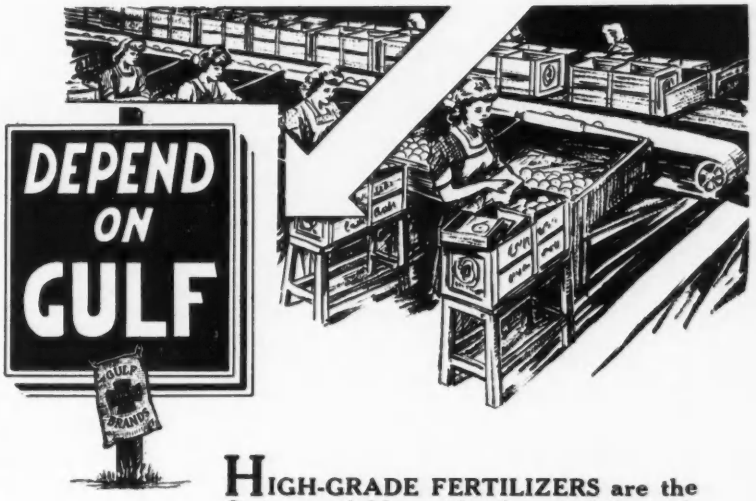
The other exemption from the overtime provisions applies to industries which have been found by the Administrator of the Divisions to be seasonal in nature. Among the industries which are entitled to this exemption are the canning of perishable or seasonal fresh fruits and vegetables—and also the first processing, packing and storing of these commodities.

Now, like the exemption I previously discussed, this "seasonal" exemption may be taken for a period up to and including 14 weeks in the year; and it is an exemption from the overtime provisions **only**. But note this—unlike that other exemption, this "seasonal" overtime exemption contains a restriction on the number of hours which may be worked without payment of overtime. During those 14 weeks in which you may take the "seasonal" exemption, you must pay at least one and one-half times the employee's regular rate for all hours worked in excess of 12 in a day or 56 in a workweek.

And here's another point you will want to know about the "seasonal" exemption—this exemption is an **industry** exemption and applies not only to employees who perform canning operations, but also, for example, to workers in an office of a cannery, even though the office is not located on the cannery premises, and to such workers as maintenance and repairmen.

As a result of these two 14-weeks exemptions, you can readily see why it is likely that you may be able to handle a large portion of your pack with very little overtime pay, even though you must, as I've said, comply with minimum

For Fruit that Grades High in the Packing House.....



HIGH-GRADE FERTILIZERS are the first essential in production of high-grading fruit. DEPEND ON GULF for the right plant foods in the right amounts at the right time to keep your grove thrifty. DEPEND ON GULF FIELD SERVICE to help you work out a complete better fruit program that is SAFELY economical. Your local GULF Field Man will be glad to talk over your grove problems from A to Z — and give you recommendations in tune with the times, including a thrifty spray schedule using SHERWIN-WILLIAMS AGRICULTURAL CHEMICALS. Ask him to call now.

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wage provisions. And by the way, the weeks during which you claim exemption need not be taken consecutively. I might add that the Divisions' record-keeping regulations require that you post the weeks taken under each of these exemptions and show them in your records.

TELLS OF "AREA OF PRODUCTION"

Now let's consider the remaining exemption I promised to tell you about—and I'll refer to it as the "area of production" exemption. Under this exemption, employees engaged within the area of production in canning agricultural or horticultural commodities—or in handling, packing, storing, or preparing them in their raw or natural state—for **market** are exempt from both the minimum wage and overtime provisions, on a year-round basis. Because I believe most of you are cannery operators, I'll just confine my remarks to how the exemption applies to cannery employees.

To be within the "area of production" a cannery must meet certain requirements set forth in regulations issued by the Administrator, whose duty it is to define the "area of production." As many of you may know, the present definition differs from a former definition, which was invalidated by the Supreme Court in the **Holly Hill Fruit Products** case, because it included a test limiting the number of employees in a plant. I mention this in order to point out that some of you may now be able to take the exemption which you were denied under the old definition, while other establishments formerly exempt may now be outside the area of production. The definition now in effect is expressed in terms of mileage and population—but more about its exact terms later.

I think it advisable to consider first the meaning of some other words used in the language of the exemption. You may be wondering about "agricultural or horticultural commodities." Included within the meaning of this term are not only fresh fruits and vegetables, but **any** agricultural commodities as they are customarily harvested and marketed by the farmer, or as they normally come from the farm and before their natural state has been changed or destroyed.

Thus you can see why it is that employees who can grapefruit, for example, could qualify for this exemption if they meet its other requirements, but employees who are canning spaghetti could not, since a substantial part of the ingredients making up canned spaghetti are not agricultural or horticultural commodities.

NOT ALL EMPLOYEES MAY BE EXEMPT

Next, I want to make it clear that this exemption applies only to those workers who are actually engaged in **canning** agricultural or horticultural commodities. In other words, the exemption ordinarily does not apply to all the employees of a cannery. Among some non-exempt classes of employees are office workers, maintenance men and guards, for example.

You may have noticed I said that employees, to qualify for exemption, must be canning commodities **for market.** The Divisions consider canning operations to be performed "for market" if the employer disposes of his canned goods in the form in which the canning operations leave them. In other words, the exemption will not apply if the employer is going to process the canned commodities further before marketing them.

To illustrate: It is quite possible that some cannery employees might be canning grapefruit for later recanning by the same employer into—say—a fruit salad mix. As a result, the employees engaged in the original canning of the grapefruit would lose the exemption, because they were canning for recanning, instead of canning "for market."

Now having disposed of these points, let me focus your attention on an analysis of the definition of the "area of production" as it applies to the canning industry.

In order for cannery workers to be employed within the area of production, three over-all qualifications must be met.

In the first place, the cannery must be located in the open country or in a rural community;

Second, the cannery must obtain not less than 95 percent of the fruits and vegetables which it cans from a distance of not more than 15 straight-line miles from the plant;

Third, it is necessary that these fruits and vegetables come from what the Divisions have defined as "normal rural sources of supply."

Now I should like to clarify the terms I just used.

"Open country or rural community" does not include any city, town or urban place of 2500 population or greater. Neither does it include areas within certain distances of cities and towns, depending on the population of the latter.

Thus, a cannery will be in the "open country or in a rural community" if it is outside a city, town or urban place of 2500 population or greater, and if it is more than one mile from the limits of a city or town with a population of 2500 or 50,000, and more than three miles from the limits of a city with a population from 50,000 to 500,000, and more than five miles from the limits of a city of 500,000 or greater population. You should check on population by referring to the latest United States Census report, published in 1940.

Assuming that the 15-mile distance requirement is met, you will next want to know how you may judge whether fruits and vegetables are received from "normal rural sources of supply."

To meet this requirement, these commodities must be obtained by the cannery from one of the following sources: First, farms; second, farm assemblers, or other customary supplying establishments which are located in the open country or in a rural community; third, farm assemblers or other customary supplying establishments which are **not** located in the open country or in a rural community, provided it can be shown that the fruits and vegetables the cannery receives from them originated on farms within 15 miles from the cannery. It should be remembered that all these suppliers must be located not more than 15 miles from the cannery.

The period for measuring the 95 percent of receipts will ordinarily be the last preceding calendar month of operation in which a cannery has operated for at least two workweeks.

You will note that this 95-percent requirement allows the canner a 5-percent tolerance which may be very useful because it may enable him to take the exemption in spite of the fact that he may receive an occasional shipment from a remote farm, or other distant supplier, or some other sources which can't be determined. This tolerance applies to the total of all the fruits and vegetables a cannery receives during the month under consideration.

Thus, if you are canning three agricultural commodities, and you receive more than 5 percent of one

of them from disqualifying sources or distances during the month, your cannery may still be able to take the exemption, if the total receipts from disqualifying sources or distances do not exceed 5 percent of the total receipts of the three products combined, for that month.

And finally with regard to these exemptions, I want to emphasize that, if in any workweek you have an employee who is engaged in both exempt and nonexempt activities, that employee will not be entitled to exemption during that workweek.

Now that I've given you information about the three exemptions of special interest to the canning industry, I might mention an exemption from the minimum wage and overtime provisions which applies in any industry to persons employed in a bona fide executive, administrative, professional or local retailing capacity or as outside salesmen.

For this exemption, requirements concerning the conditions of employment in each of these categories have been established by the Divisions. Generally speaking, these requirements not only include salary tests, but also specify in some detail the types of duties in which employees must be engaged in order to qualify for exemption. I shall not go into these details, but if any canner wants to claim this exemption, I suggest that he consult the nearest office of the Wage and Hour and Public Contracts Divisions for copies of the pertinent regulations. Lack of caution in claiming these exemptions has led to many inadvertent violations.

CHILD-LABOR PROVISIONS OUTLINED

Finally, I should take up the child-labor provisions of the Wage and Hour Law, as the Divisions' past inspection experience indicates that the canning industry in general is among those industries that show a need for greater understanding of how these provisions apply.

In your own interest, compliance with the child-labor provisions is important, for the shipment or delivery for shipment of goods in interstate commerce is prohibited if within 30 days before removal of the goods from an establishment minors have been employed contrary to the child-labor requirements.

A broad rule that would be well to remember is that the Wage and Hour Law sets a minimum age of 16 for employment in general, with an 18-year minimum for occupations which have been designated as hazardous by the Secretary of Labor. Children of 14 and 15 may, however, be employed in limited nonmanufacturing and nonprocessing occupations, under stringent regulations as to hours and conditions of work.

To put it another way, no one under 16 may be employed in the manufacturing or processing of canned goods, or in occupations preliminary or supplementary to these activities, if they are performed as an integral part of the manufacturing or processing operations. Nor may anyone under 16 be employed in any duties whatsoever that take place in a workroom or workplace where these operations are carried on.

Moreover, an 18-year age minimum applies to some types of work in which cannery employees are engaged from time to time. Therefore, I'd like to point out that under various hazardous occupa-

(Continued on page 22)

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Citrus Production Problems

HOWARD A. THULLBERY

AT MEETING OF FLORIDA STATE HORTICULTURAL SOCIETY

The topic assigned me is "Citrus Production Problems" and since all citrus production problems today revolve more or less around production costs, I shall discuss Production Costs.

During the 1945-46 fruit season, the citrus growers of Florida were little concerned about Production Costs. In the season of 1946-47 they became quite production cost conscious and since that time have steadily become more so.

We felt, back in 1945-46, that the time would come when this would be true, and at that time selected at random what we considered were 33 representative groves of the Haines City Citrus Growers Association. These groves varied in size from 5 to 105 acres each. The acreage totaled 554 acres with 30.4% of the trees being grapefruit. The trees were from 20 to 35 years of age.

The costs were kept for the season beginning August 1st and running to July 31st of the season the crop was marketed.

These groves were entirely under our supervision. The Association furnished all supplies and did all the work. This enabled us to keep accurate records of all moneys spent and allowed us to arrive at accurate Production Costs.

We maintained then, following a program designed to produce quantity and quality fruit, and are still of the opinion that anything cut from the program in the care of citrus, that is needed to produce quantity and quality fruit, will in the end cost rather than save the grower money.

Let us review the Chart showing these costs over the seasons 1945-46, 1946-47 and 1947-48.

You will notice the acreage dropped the third season from 554 to 548 acres. This was due to 6 acres of one grove being sold.

The production for the season 1945-46 was 211,071 boxes, increasing to 219,026 boxes in 1946-47 and 263,679 boxes in 1947-48, or an average yield of 381 boxes, 395 boxes and 481 boxes per acre for the three seasons.

The costs over the three seasons were $138.30, $168.67 and $137.71 per acre.

In commenting on the breakdown of the per box costs, we would point out that only 163 acres of the 554 were fired, although this cost is spread over all fruit on the 554 acres. Likewise only a portion of the groves were irrigated.

Regarding the items of spraying and dusting, and spray and dust materials, we would call your attention to the fact that for the season 1947-48 dusts were applied throughout the year with the exception of the Melanose and oil sprays, while for the first two seasons dusting was practiced only during the time all spraying machines were busy applying the oil spray application. All groves received an oil spray yearly.

The pruning costs ran $.023, $.027 and $.024 per box. On the acreage basis you can readily see that more money was spent on this item in the 1947-48 season than any other year. This was due, first, to the heavy scale infestations of the 1945-46 and 1946-47 seasons and second, to the fact that many of the groves were lifted and some hedged the past season in order that they might be more easily cultivated and sprayed.

The fertilizer and amendments cost shows a considerable decrease in the 1947-48 season, dropping from around $.18 per box to $.12 per box. Aside from the increased production this was due to a cut in total units of plant food and a more economical mixture being applied.

Under the miscellaneous costs you notice a sharp increase for the 1946-47 and the 1947-48 seasons. This is due to the replacement of dead or missing trees and their care in these years. During the war we had neither the trees nor the labor to make these replacements.

The total box costs for the three seasons were $.363, $.427 and $.286 respectively.

The lowest box cost we had the past season was on a 5 acre grapefruit grove which was $.12 per box. The production was 915 boxes per acre and the per acre cost was $109.47. On a 10 acre block, one half grapefruit and one half oranges, the cost was $.172 per box with a production of 789 boxes per acre and an acre cost of $136.20. On a 5 acre block, 80% oranges, the cost was $.232 per box with 573 boxes per acre and an acreage cost of $136.20. The highest per box cost was $.516 on a grove 80% oranges that was both fired and irrigated and had an acreage cost of $148.11 and a production of 292 boxes per acre. The highest acre cost was $199.08 with a per box cost of $.244 and production of 813 boxes per acre.

Comparative Production Costs

Cost Per Acre	1945-46	1946-47	1947-48
Number of Groves	33	33	33
Number of Acres	554	554	548
Number of Boxes	211,071	219,026	263,679
Boxes Per Acre	381	395	481
Percent Trees Grapefruit	30.4	30.4	30.4
Costs Per Acre	$138.30	$168.67	$137.71
Costs Per Box	**1945-46**	**1946-47**	**1947-48**
Firing	$ .008	$ .025	$ .016
Irrigation	.017	.025	.008
Spraying and Dusting	.062	.060	.042
Spray Materials	.052	.051	.039
Cultivation			
Pruning	.011	.011	.009
Fertilizing	.023	.027	.024
Fertilizer and Amendments	.010	.009	.006
Hauling—Truck	.173	.183	.120
Miscellaneous	.005	.004	.005
	.002	.032	.017
Total	.363	.427	.286

64% of the trees were grapefruit.

The past season showed a decrease in the per acre cost of $30.96 or 18.4% from the 1946-47 season. However, our per box cost was $.141 less or a decrease of 35%.

This means that 56% of the 33% decrease in the per box cost was due to spending less money on the groves and 44% of the decrease was due to increased production.

Putting it another way, had the production in 1947-48 been the same as in 1946-47, the per box cost would have been approximately $.35 instead of $.286.

While I believe we should do everything possible to improve quality, we must have production if we are to keep production costs down. Furthermore, I believe a heavy set of fruit is the number one requisite of a quality crop. You can't expect quality on a light crop of Valencia oranges regardless of what program you follow. I can't go along with the fellow that says he wants to grow less and better fruit.

We have pointed out the lower spraying and dusting costs of the 1947-48 season. We believe a saving can be made by dusting rather than spraying, except for the melanose and oil sprays, and the quality maintained provided proper equipment is used. We would hesitate to follow a dust program unless a California type duster or a helicopter were available and proper speed maintained. However, research is being done on different type dusters and suitable equipment may soon be available.

Another important factor in low cost production is proper management of labor and equipment. Work should be planned well in advance so as to cut delays between operations to a minimum. Labor should be trained for the job they are to do and properly supervised. The equipment they use should be good and kept in good repair if production costs are to be kept down.

In summary, we believe it to be economical to use that program which will give us the largest quantity of the best quality fruit.

That anything omitted from the program that the grove needs to gain this end will, in the long run, cost rather than save the grower money.

We believe that the number one requisite of quality, especially on Valencia oranges, is heavy production and that it is a major factor in low box costs.

Other factors tending to lower costs are economical fertilizer mixtures, dusting a part of the year, provided proper equipment is available, and proper management of labor and equipment.

Acknowledgement is made to the Haines City Citrus Growers Association for use of data used in this paper. Also to Professor L. W. Zeigler and W. L. Tait for compilation of same.

Growers Are Advised Of Federal Wage-Hour Law Child-Labor Provisions . . .

Birmingham, Alabama — Rural children deserve the right to attend school as much as city children, and work in harvesting the crops this Fall should not cheat them out of it. Where school attendance requirements and employment conflict, Uncle Sam helps tip the scales in favor of education.

This was the statement this week of Joseph C. Noah, Regional Director of the Wage and Hour and Public Contracts Divisions, U. S. Department of Labor, as he pointed out that the child-labor provisions of the Federal Labor Standards Act take special note of the need to protect children in agriculture where employment for interstate commerce comes into competition with school.

"A child under sixteen years of age working in agriculture may not be hired to work during the time the laws of his State require him to be in school," Mr. Noah said. "This means," he explained, "that a farmer may ship farm products or other goods in interstate commerce if within 30 days before the removal of these goods he has employed a child under these circumstances on the farm where the goods were produced."

Mr. Noah cautioned that this provision of the Fair Labor Standards Act applies to a farmer whether he himself ships the goods directly out of the State, or whether he delivers them to a warehouse or wholesale dealer that does the actual shipping. Further, he said that growers of vegetables, fruit, cotton, and other crops that are delivered to canning, processing or refining establishments within the State have the same obligation under this law not to hire children under 16 while they are legally required to attend school, as have those farmers whose products move directly out of the State, if the resulting canned, processed or refined foods move in interstate commerce.

Local school officials can advise the farmers whether a particular child is required to attend school. Those farmers who may be in doubt about the application of the law to their businesses, Mr. Noah said, should make inquiry at his office, the Wage and Hour and Public Contracts Divisions, U. S. Department of Labor, 1007 Comer Building, Birmingham 3, Alabama, or at the nearest branch office.

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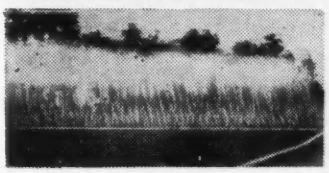

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Prepackaging At Shipping Point Has Many Advantages . . .

Standing high on the list of advantages fruit and vegetable cooperatives see for prepackaging are increased volume, better retailing, better brand identification and advertising, cleaner and neater displays, increased shelf life, and more economical handling. These findings as well as the problems involved are reported by the Farm Credit Administration as a result of a Research and Marketing Act project just completed.

This report showed some 44 cooperatives with experience in prepackaging at the shipping point, with citrus, white potato, and apple associations leading the list. Other commodities handled in smaller quantities were celery, cranberries, onions, blueberries, grapes, dried peas, plums, rhubarb, and tomatoes. Nearly a third of these cooperatives started prepackaging during the two postwar years, 1946-47. All of them handled only a part of their sales in consumer-size containers and some were pursuing the matter more or less experimentally merely to keep abreast of competition.

Cooperatives have had the same problems in prepackaging as other parts of the industry. Problems experienced in prepackaging include the difficulty of keeping down costs and finding satisfactory containers, keeping the quality of pack high, improving packaging equipment, building up consumer demand, and increasing marketing and transportation efficiency.

At the same time, these cooperatives suggested a number of research problems they and others in the field might go into to help overcome some of these prepackaging problems.

Long distance lines today are busier than ever. Business men, manufacturers, builders . . . all use the telephone as the quickest method of communication. Overloaded lines cause telephone "traffic jams." Please be patient if you have a few minutes' wait when calling long distance. Thank you.

PENINSULAR TELEPHONE COMPANY

THE CANNERS AND THE FEDERAL WAGE AND HOUR LAW . . .

(Continued from page 19)

tions orders, no worker under 18 may be employed as a driver or helper on a motor vehicle; or in occupations involving the operation of power-driven woodworking machines—which may be used in the making of boxes or crates, for example; or in occupations involving the operation of power-driven hoisting apparatus, such as elevators, cranes, derricks, hoists or high-life trucks.

Of course, it is evident that in order to avoid violating these child-labor provisions an employer must have accurate information as to the ages of the minors who work for him. And you all realize that youngsters do not always make reliable statements about their age.

What then is your best protection against hiring under-age minors? You should have on file an age certificate for all employees under 18 and for those workers who claim to be 18 or 19 and who are employed in hazardous occupations.

An age certificate is a statement of a minor's age, issued in virtually all States by State and local officials. It is accepted as proof of age under the child-labor provisions of the Wage and Hour Law and the Walsh-Healey Public Contracts Act, as well as under the provisions of State laws. If the child-labor standards set by the Wage and Hour Law and by your State law differ, the higher standards are to be observed.

BLITCH AND NORRIS HONORED, BY COUNTY AGENTS' ASSOCIATION

County Agents Loonis Blitch of Alachua and R. E. Norris of Lake have received the distinguished service award of the National County Agents' Association for 1948. The award was made during the annual session of the organization in Chicago recently.

CHANGE OF NAME

Incorporation of the Southern Pipe and Supply Company, of Orlando, was announced by Ben Shafer, vice president and general manager.

The new firm, formerly the Orlando branch of the Florida Pipe and Supply Company, was organized to supply farmers and growers with a more comprehensive sales and service program, Safer said. He added that there will be no change in management or policy.

Other officers of the Southern Pipe and Supply Company, in addition to Safer, are L. E. Wolfson, president; Saul Wolfson, second vice president; Sam Wolfson, secretary; and Cecil Wolfson, treasurer.

Classified Ads

CITRUS TREES for fall and spring delivery. All varieties. F. Gould Garcia, Box 843, Lakeland, Florida.

CITRUS TREES—Usual varieties and rootstocks. Accepting reservations for Fall 1948 and Spring 1949 delivery. Clay Hill Nurseries Co., Box 2880, Tampa, Florida.

CLEOPATRA MANDARIN Seed and Seedlings, also contracting for budded trees on Cleopatra.

RUBY RED GRAPEFRUIT and all standard varieties on lemon and sour stock. Grand Island Nurseries, Eustis, Florida.

IMPROVED JEWEL PEACH TREES — Ten years selection from our commercial producing orchards. January delivery. R. P. Thornton, Box 2880, Tampa, Florida.

FOR SALE — Mallory Sterilizer 30 GPM, reconditioned, ready for immediate installation in your plant. Priced for quick sale. Terms. The safest, fastest, most economical method of sterilizing your fruit juices and liquid food products. Address: B. C. SKINNER MACHINERY CO. 945 Douglas Street Dunedin, Florida

SUPERIOR CITRUS TREES — All commercial varieties and rootstocks. Choose from 10,000 trees, ½" to 1½" caliper. Reduced prices quoted without obligation on your needs. WARD'S NURSERY, Avon Park, Florida.

ALUMINUM LADDERS — Buy direct from Manufacturer and Save. For Industrial and Commercial Users. Fruit picking ladders made to specifications. Safety grip, positive locking rung. Inquiries invited. Lifetime guarantee. CHART ALUMINUM PRODUCTS CORP., Meriden, Conn.